DOCUMENT RESUME

ED 478 902 SE 067 818

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TITLE	Stories from the Schools Participating in the JASON Project.
INSTITUTION	Education Development Center, New York, NY. Center for Children and Technology.
PUB DATE	2001-09-00
NOTE	49p.
AVAILABLE FROM	Education Development Center, Inc., Center for Children and Technology, 96 Morton Street, New York, NY 10014. Tel: 212-807-4200.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	EDRS Price MF01/PC02 Plus Postage.
DESCRIPTORS	*Educational Technology; Elementary Secondary Education; Instructional Effectiveness; *Program Evaluation; *Teacher Characteristics; Teaching Methods

ABSTRACT

The core activity of the first year's in-depth study of the JASON Project impact on student learning centered on school site visits. The Center for Children and Technology (CCT) and JASON staff developed a set of criteria to select a diverse group of participating schools. One of the most important dimensions was based on the JASON Foundation for Education's (JFE) interest in learning how their program works for all kinds of students. Because the JASON Project has been under way for a number of years and already supports a large, committed community of educators, the program worked with JASON schools with various degree of implementation experience with the JASON curriculum and that serve different populations of students. With the help of JFE staff, 30 schools were identified which were then pared down to the final eight selected to participate in the study. These eight schools reflect the diverse learning contexts in which JASON is being implemented on such characteristics as student background and ability and teachers' experience in using JASON. Furthermore, the participants in this study come from eight schools around the country: in Arkansas, Texas, Michigan, Pennsylvania, Ohio, California, New York, and Wisconsin. There were a total of 20 visits to school sites. At each site, two CCT researchers conducted classroom observation, interviews with teachers and principals, and a student inquiry test. They also collected data using a school profile questionnaire, a teacher survey, and a student survey. The stories form the schools participating in the JASON Project are organized into two main sections: (1) a summary of the common themes across all school sites; and (2) a report on each school. The first section focuses on JASON's impact on teachers and students. The second section shows how JASON is being implemented in different school settings as well as taught in four different classrooms. (Author/MVL)

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Stories from the Schools Participating in the JASON Project

September 2001

Wendy Martin
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Introduction

The core activity of this first year's in depth study of the JASON Project impact on student learning centered on school site visits. The Center for Children and Technology (CCT) and JASON staff developed a set of criteria to select a diverse group of participating schools. One of the most important dimensions was based on the JASON Foundation for Education's (JFE) interest in learning how their program works for all kinds of students. Because the JASON Project has been under way for a number of years and already supports a large, committed community of educators, we worked with JASON schools with various degree of implementation experience with the JASON curriculum and that serve different population of students.

With the help of JFE staff, we initially identified 30 schools, which were then pared down to the final eight (8) selected to participate in the study. These eight schools reflect the diverse learning contexts in which JASON is being implemented on such characteristics as student background and ability and teachers' experience in using JASON. Furthermore, the participants in this study come from eight schools around the country: in Arkansas, Texas, Michigan, Pennsylvania, Ohio, California, New York, and Wisconsin.

There were a total of 20 visits to school sites. At each site, two CCT researchers conducted classroom observations, interviews with teachers and principals, and a student inquiry test. They also collected data using a school profile questionnaire, a teacher survey, and a student survey.

The stories from the schools participating in the JASON Project are organized into two main sections: (1) a summary of the common themes across all school sites; and (2) a report on each school. In the first section, we focus on JASON's impact on teachers and students. In the second section, we show how JASON is being implemented in different school settings as well as taught in four different classrooms.

Common Themes Across School Sites

Based on our interviews with teachers and administrators and classroom observations, we were able to identify a number of common themes that seemed to characterize participants' experience with the JASON Project across multiple study sites. These common themes are grouped into three areas: the contextual issues and challenges present in the environments in which the JASON Project is being implemented; JASON impact on teachers; and JASON impact on student learning.

Contextual Issues and Challenges

The JASON curriculum is adaptable.

One of the things that teachers found most valuable about the JASON curriculum was that it was flexible enough for them to adapt it to the needs of their classroom. The teachers we worked with in our study characterized their use of the JASON Project as "picking and choosing" topics and activities that were consistent with their existing curriculum. All of the teachers had specific content areas to cover and standards to meet for their grade level, although these varied widely in each state, and some teachers had more freedom than others to improvise. Most teachers, however, felt that it was not difficult to align the JASON material with their content standards.

> *"We have unit plans written up," said one teacher. "The JASON curriculum is more of a general unit plan, because we don't know from year to year exactly what we're going to be covering, but the way the curriculum is we can dovetail it into any part of our existing curriculum. Plants, animals, weather, all of that fits so we can pick and choose and blend and go in all directions. Right now, focusing on JASON, we can still cover the requirements that we need to do for the animal kingdom, for the plant kingdom. We can show where we're going to meet those standards."*

Teachers gave different reasons for choosing certain JASON activities and content to integrate. For some, the determining factors were state or district standards. "I have never taken the curriculum and taught every single lesson. I probably never will. It's too much. You pick and choose activities that you can connect to your state curriculum, making sure you hit your district benchmarks." Another stated that she selects those labs and activities that seem especially effective. "I'll look through the JASON manual and when I see topics that tie into the standards, I'll pick and choose. If it looks like a topic where the kids would understand the concept better if we used that JASON activity, then I'll use that instead of the material I already have." Still other teachers were conscious of choosing material that would help prepare the students for the Tele-presence session. "We start off with the letter from Dr. Ballard, then they keep adding the information about the different scientists to their portfolio so they'll eventually know all the different research scientists before we go to the live broadcast. When they go and see the scientists on the screen, they can relate."

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Not only do teachers pick and choose activities from the current JASON curriculum, some also reuse activities from previous years that they have found particularly effective. The project we observed at the school in Wisconsin, which involved students designing their own birds, came from a previous year's curriculum. Another teacher mentioned that her students liked one activity from the Extreme Environments curriculum so much that she would bring it back this year.

> *"We grew plants like they do in space. They all got excited about that. You take the seeds and glue them onto a piece of paper towel and put it on a grid and then you can see how much they grew each day. I'll probably do that again this year although it's not in the curriculum. . . . They are definitely reusable activities."*

The fact that meeting standards is central to a teacher's responsibility, and some states have narrower standards or higher-stakes testing than others, means that some teachers are less able to pull in JASON content and activities from year to year as the curriculum changes.

> *"Two years ago it was on the rain forest and we connected quite a bit," said one teacher. "Last year it was more on outer-space and oceanography and I tied in the rocketry unit and that was really about it as far as connecting. It just wasn't something that went with our curriculum that much. This year I'm going with it extensively with the biomes and the climate of the land and all the geology aspects."*

However, if multiple grades in a school or district use JASON, then the material can be more easily integrated by different teachers each year depending on their specific content standards. "Last year third grade was instrumental because they took that ocean component," said a teacher whose entire district uses JASON. "This year they're not because it's on volcanoes and they don't teach that in third grade. They teach it in fourth grade so now the fourth grade teachers are more instrumental than they were in the past. My classroom will always be involved with it. The sixth grade team at our school all think that JASON is a necessity so we all make it fit one way or another. On the other hand we don't have the state test [in sixth grade], so it allows us a little more freedom."

The success of JASON depends on the teacher.

Most participants in our study described the JASON Project as an innovative, evolving curriculum. Such a curriculum attracts and inspires certain kinds of teachers. After we visited the eight participating JASON schools two to three times over the year, observing the classes, and talking to the teachers and administrators, it became apparent that, although they taught in very different environments, the teachers in our study shared certain characteristics. They all were identified in some way as leaders in their school or as particularly innovative teachers, they all mentioned that they took an experimental, hands-on approach to teaching science, and they all welcomed the challenge that JASON's changing curriculum offered.

> *One teacher felt that learning about a new topic each year "keeps [JASON] fresh. If it became second nature we wouldn't have the same excitement to put into it. I learn as I go along. That's good for me." Another teacher agreed. "[The new topic] keeps us current and aware. We don't teach the same thing year after year. We've always said after we've finished with a year of JASON it's like we've finished a college course, the background work that we do, the research that we do. We don't just do what's in the book. We go a little further. We like to see the reactions of the kids and I think the kids are getting so much more out of it."*

Although some of these teachers claimed to use a hands-on approach to science even before becoming involved with JASON, many admitted that JASON made doing this kind of work much easier.

> *"Even though we did activities before, the JASON stuff actually shows us how to do activities, so we don't have to make up everything." A teacher, who used the film canister volcano activity said he often gets inspiration from the JASON materials. "The thing that I like about [JASON] is that they have really good ideas for labs. I can say, 'what do I want to teach with JASON and how will this lab support it?' I look for labs that bring about conversations. Those kids will never forget those film tubes spraying all over them today." Another teacher felt that the curriculum helped her organize her teaching around a theme. "JASON gives you more ideas and gives you a focus. You have topics for the year and then you can expand from there."*

Participants felt JASON offered compelling classroom experiences. They understood, however, that it required considerable effort on their part to make JASON work in their classrooms. "The curriculum itself isn't going to do anything unless you have the right people working with it. If you're excited about it then that will excite the kids and they're going to do well with it."

Administrators in general were supportive of the program, but they also recognized that it takes a committed teacher to make the program effective.

> *"When I say JASON is a great project, it's a great project if the right people are using it in the right ways. You have to have the people who are doing it with the right attitude. JASON can not replace your science program." Another principal mentioned that in order for JASON to be successful, "of course the key is the teacher. You can have all this stuff in writing but until she really wants to be part of it it's not going to work."*

In most cases in this study, JASON became a part of the school through a bottom-up process. In some instances a teacher who believed in the curriculum would use it and other teachers would become interested and want to get involved; in other instances a PIN site coordinator would offer it to a school and teachers could opt to participate. In a few cases,

after enough teachers became involved, the curriculum became part of the school's required curriculum for a certain grade level. In one case, however, the impetus to bring JASON to the school came from the top-down, with the district requiring its use, rather than from teachers choosing to participate. "In this school it's mandatory for all sixth graders to receive the JASON Project," said the principal. When asked whether all of the teachers follow the JASON curriculum, she replied, "They'd better."

The JASON teacher from this site who participated in this study is a seventh grade teacher who uses the curriculum of his own volition. In his experience, students come to his class with a negative view of the JASON Project because of the way they were exposed to it in sixth grade.

> *"If you were to go out and ask the kids about the JASON Project the first thing you would hear is, 'ugh!' They don't like it. A lot of times the teachers who teach it, especially in sixth grade, they're not science teachers. They don't know how to use it as much. So they do JASON as a textbook. Most of them are very negative towards it. In sixth grade it's mandatory, and if you're weak in that area, if you don't understand geology or watersheds, you have to learn it all and think of fun ways to present it and if you don't really like it that puts a strain on the teachers. If the teachers don't like it then the kids won't like it . . . Honestly I don't think our students see it as anything other than just another unit in the curriculum."*

It should be noted that this entire district has cut its JASON funding this year. Just as the decision to use JASON was top-down, so the decision to end involvement in JASON was top-down as well.

"Thinking that every teacher is going to do JASON is unrealistic," said a principal from another school. "I don't think it fits everyone's style. As it is I think the people doing it are motivated and enthused about doing it." Many teachers in his school and the entire district were participating in the JASON Project, but it wasn't a requirement. In his experience, JASON became attractive because teachers and administrators observed its impact on students.

> *"I think in most cases for the JASON project to go it takes a person who is willing to champion the thing. . . . [The study teacher from that school] really is Mrs. JASON in the building. The kids do things that attract attention. They have this huge space station and it's up on the stage so the kids get curious about it. Teachers say, 'You know, I'm seeing the value of this.' So I think that she has championed it and other people are seeing that it can work and it's growing for that reason."*

District and school constraints impede the implementation process of JASON.

The conditions under which teachers work can make it difficult for them to take full advantage of the JASON Project. The most significant limitations include time, technology, state standardized test requirements, as well as training and supply.

One of the most significant limitations imposed on teachers was their ***lack of time***, both with colleagues and, more importantly, with students. Lack of time with colleagues made it difficult and sometimes impossible for a few teachers to initiate interdisciplinary projects. Lack of time with students meant that some teachers were unable to do complete labs or take them on field expeditions.

> *"The main problem here is that I teach 35-minute classes," said one teacher. "It's hard to get everything in and accomplished. That's just what they've come up with to get all of our specials in and to get all the state requirements of so many minutes per subject area. It's tough that way." Another teacher said she tries to use the JASON labs in her classes, but she has to adapt them to fit her schedule. "A lot of the activities, say they take an hour to two hours, with the way our school is set up that's not possible. Just trying to modify the activities so that we can still use them is challenging." Still another teacher claimed that time limitations prevented her from doing outdoor activities. "I haven't done the field experiments. I feel like, with 20 kids per class . . . taking them on a field outing, it's just difficult. We have 50 minute-classes. Some schools have block scheduling and it's easier for them. If I could just pick one class and do that one with them it might work, but it's hard to do it with just one. The kids think it's unfair."*

Of the teachers we studied, those who seemed most able to take full advantage of the JASON Project resources were those who had more flexible schedules and could take the time either on a regular basis or on special days to do the longer activities.

Another limitation was a lack of access to technology, which prevented some teachers from making use of Team JASON Online. All but one teacher had at least one computer lab in their schools, but depending on how many students attended the school and how those labs were used, teachers could have difficulty incorporating technology use into their students' JASON experience. "We have a computer lab," said one teachers, "but it's used to teach computer skills to kids. We can't check it out for our own use. My kids don't use the JASON website." Another teacher observed that her school's method of technology access made it hard to have students use computers regularly, which limited the TJO activities they could do. "I would like to use the student journal on there, but I don't know that I'll be able to do that because we only have that one computer lab and everyone has to sign up for that. I may just have them keep a pen and paper journal." Another teacher felt that entering all 180 of her students into the TJO system and giving them passwords was too time-consuming. The lack of students' home access also prevented some teachers from integrating a large amount of technology into their lessons.

> *"About 25–30% of our kids have Internet access at home," said one teacher. "I thought about incorporating things that they could do online from home, but I have so many kids who can't do it at home that I didn't think it would be fair. I try to make sure my curriculum can reach everybody."*

The most serious teacher constraints, however, involves covering the material appearing on ***state standardized tests***. Although a number of teachers found the JASON material in line with their state standards, the specificity of some state tests can mean that from year to year JASON may have more or less relevance in a classroom. "In terms of fitting in specific area of the curriculum," said one principal, "the JASON Project changes each year. It would just be happenstance that it would match what we're supposed to teach in the sixth-grade or fifth-grade level." The teacher from that same school agreed that test content usurps all other material she might want to teach. "It's stressful all the time now. We realigned the curriculum last year to match the proficiency test first of all. . . . The utmost, the foremost is to match this proficiency test." This meant that much of the JASON content would have to be taught at the end of the year. "Geology isn't covered on the proficiency test so we do it in April. Our tests are in March."

The stress accumulated around these state tests means that teachers may be unwilling to introduce something new into their curriculum. "There are my state tests that are coming in for fifth grade level," said one principal. "If you went to a fifth-grade teacher and said, 'Hey we want you to do JASON,' they might just throw their paper in and say, 'I'm retiring. I'm out of here. There's not another day. I can't do anything more, you know.' You have some people that are like that. You have some other people that are more open to trying something new." This principal admitted that, even though he supports JASON, he could not allow it to take too much time away from the state standards.

> *"I do say that JASON is a wonderful thing but you have a curriculum to teach to and you have to find a way to work it in. I think this year it's volcanoes isn't it? That's part of sixth-grade science; tectonics and studying volcanic activities are in the state benchmarks for sixth grade. If I had a fifth-grade teacher doing JASON and not getting their curriculum covered, then I would have to say, 'You know, JASON is good but if you're going to use it you have to find a way to include some of these other things.'"*

In this principal's view, the kind of learning that JASON promotes cannot be easily measured by quantifiable, standardized tests. "You can give a kid a list of terms and mark them right or wrong, but if you ask a kid to reason, to figure why, to make a prediction, those are skills that in my opinion are extremely difficult to evaluate properly."

Finally, ***training and supply*** are expensive for some teachers. Schools and districts offer teachers varying levels of support for participating in the JASON Project. One district that requires all its sixth-grade teachers to use JASON pays for training and supplies, but in most other cases, funding for supplies and training is inconsistent, and sometimes

nonexistent. Often teachers must be resourceful or pay out of pocket in order take part in JASON activities and workshops.

Although JASON designs activities and labs that use inexpensive, everyday materials, as one teacher observed, when you have dozens of students, the costs can add up.

> *"They call it kitchen science where pretty much everything you need can be found in the kitchen, but those humidity strips that we got [for the lava tube activity], they're a dollar a piece. I have 58 students working on it and you put them in groups to minimize the cost, but I spent probably $100 on that lab. You don't have $100 to spend on a lab. You truly don't. That's more than the money we're allocated. So that's a definite downside. Half your grocery bill is often for your classroom."*

Paying out of pocket for supplies is difficult for teachers already earning modest salaries. Some have made special efforts to find bargains or ask for donations of materials from local businesses. One teacher said that she had established "special relationships with the merchants we deal with" to make sure she could get all the supplies she needed each year at a reasonable price. Another teacher observed:

> *"You have to be very organized because a lot of times you need to get things way ahead of time. It's difficult to deal with. Every summer you have to go out and purchase new things to fit in with the new theme each year. . . . Money is a big issue for a lot of districts. We're not allocated funds to support the JASON curriculum."*

Some teachers and administrators mentioned holding parent fundraisers for JASON travel and supply expenses, or charging the students a fee, but in the case of the one inner-city school in our study, where families have no money to spare, those techniques are not feasible.

> *"The kids can't pay, and the school won't do it or can't do it," said one of the JASON teachers from that school. They receive some funding from their PIN site and they also seek money from outside sources. "We have to get the funding on our own. We apply for all sort of grants from the government, corporations."*

Teachers in some schools receive little support for their JASON training. In some cases, the school or district will pay only for a few teachers to be trained, and then these teachers bring the curriculum back to their school and introduce it to their colleagues. This, however, does not allow those colleagues to practice the labs and activities for the year. As one teacher found, this approach can also make it difficult to persuade colleagues to buy into the program.

> *"The first year we were involved with [JASON] was not a very positive experience. Part of the problem was that only science teachers went to the training, and only teachers that go to the training are given the curriculum. If the other teachers on*

my team didn't go to the training, and if I wasn't pushing it on them, then it's hard to get them excited about it and willing to see if there's anything to tie into their own curriculums." Another teacher described the inconsistent support she has received over the years for training. "The first year [the workshop] was on a school day but our district wouldn't pay for substitutes, so we had to take a personal day. That second year when we had it on Saturday we were paid a stipend to come. This past year we weren't. [The PIN site coordinator] had trouble getting it financed. I think if our district knew more about JASON they might provide substitutes."

Another teacher who is a JASON trainer observed, "It's getting expensive for teachers to be trained. The price keeps going up for the district. Some teachers have to pay out of their pocket to be trained. It was $55 this year. That's the local training. The national training is a lot more. I would not go to the national training every year if [my PIN site] didn't sponsor me. In return I go out and train for the state. I don't pay anything to go to the national training, but I have to give up four weekends during the school year to go out and train. Some places will pay you a stipend and in some places you do it for free. I've been paid stipends up to $100, but you're lucky if that covers the cost for you to travel to get there, and you bring in your materials for the activities and that adds up. You do it because you love it. You have to love this curriculum to do it, because if you don't you won't do it. You have to really believe in the curriculum."

JASON Impact on Teachers

JASON changes teaching practice.

A number of teachers mentioned that their teaching practices have changed as a result of participation in JASON. The areas of change include collaboration, project-based learning, and alternative assessment.

Teachers noted that JASON lends itself to ***project-based learning***. All of these teachers had their students do project presentations as part of their JASON work, and one described how she took the idea of presentation one step further.

"Last year we had all the students teach part of the JASON curriculum for about a week. They all had to have some type of poster or display or PowerPoint presentation to get the information across to their classmates. Each group had a specific topic that they had to research and they knew they were responsible for teaching that information. . . . They looked at it differently from doing a book report, because they were actually using the overhead or the VCR or the computer to share information. Most were really excited about it. One of the biggest benefits was that, whatever their topic was, I'm sure they remember that information. They were amazed at how much they learned just having to put together a lesson."

In these JASON schools, ***collaboration*** among teachers can take different forms. Both teachers and administrators noticed that a school's involvement with JASON often led to an increase in collaboration among teachers in and across grade levels. In one school in which two different grades used JASON, the principal observed more teacher coordination across the grade-levels. "We're working hard on vertical teaming. The JASON project has done a lot for our science department. The sixth- and eighth-grade teachers are working so closely together on this. In the past the sixth- and eighth-grade teachers taught their own thing."

More often, however, teachers and administrators found that JASON inspired collaboration among teachers who taught different subjects within the same grade. One teacher described the JASON teacher teams in her school:

> *"We have sixth-grade teams. There's English and math and social studies and science, so the four of us are going to be doing different JASON activities. The English teacher's going to do the one on Hawaiian names. The social studies teacher is going to be doing the latitude and longitude with the globe, and the math teacher is doing graphs on the percentage of different kinds of people in Hawaii."*

An administrator at a school in which only one grade used JASON observed. "[JASON] has done a nice job of getting the seventh grade to work more as a seventh-grade team. We have two distinct houses (a red house and a blue house). The seventh grade definitely works together more than any other grade level."

> *A teacher at this school believed that the collaboration among teachers is reflective of what she tries to teach with JASON. "The coordination is really nice. We have a common prep every other day, all nine teachers. That's what we do, we all get together and collaborate. The other teachers are willing to give their academic time because they see connections that they can make in their classes too. They've given three academic days to JASON. That kind of models what the JASON Project is about, the teamwork, the collaboration, the problem-solving. We do that here and we try to model that with the kids."*

Along with modeling teamwork and problem-solving, the study participants noted that collaboration among teachers enabled them to take an interdisciplinary approach to a single large topic. One principal observed that although her school theoretically encouraged collaboration among teachers, she realized that "You need something like a JASON to make it happen." Another principal described the way JASON is used in his school.

> *"I don't want to teach JASON in isolation. We do JASON in science, and then the math teacher might talk about the metric system in terms of volume of ocean water or she might be teaching percentages of salt and water in different parts of the ocean. When [students] go to social studies, there are social implications of shipping on the ocean and how does that affect the ecology of the Great Barrier*

Reef and what would happen if the temperature changed? So it all ties together. I think JASON is an integrative approach of looking at things. I don't see JASON as a science class. I see JASON as a way of getting the kids' interest so we can learn to be better writers, so we can be more aware of what's going on politically with the ocean or rain forest. It creates a central focus where you can sneak in some writing and some creative thought and artistic things. It gives us a whole-brain approach to it. It's better for the kids."

Finally, some teachers mentioned that they use more varied methods to evaluate student performance. One teacher said that since she started using JASON she uses "more alternate assessments where I'm looking at [students'] projects and their presentations rather than giving them tests." Another teacher said her involvement with JASON encouraged her to try new assessment techniques. "I had heard about using portfolios in other workshops, but I hadn't thought of incorporating them until JASON. It lends itself to the portfolio because of the activities, they're usually building something or graphing or sketching something."

JASON increases teachers' use of technology.

Another way in which teachers reported their involvement with the JASON Project has influenced their teaching practice is that it has pushed them to make greater use of technology than they did previously. Although not all teachers were able to take advantage of Team JASON Online because of limited access to computers in their classrooms or a lack of training in the TJO environment, a number of teachers have said that TJO has provided them with the impetus to use computers in their teaching.

"[JASON] has definitely encouraged me to get more involved with technology," said one teacher, "and bring it into the classroom to teach kids how to research not just with paper and pencil but digging around on the Internet. I had never been involved with web chats before the JASON project."

Another teacher stated, "JASON probably forces us to use more technology. It has made me much more aware of technology and how students can use it. JASON Online, journaling online, posting messages, Ask an Expert, all of those things. I think it gives you some good guidelines. The kids are exposed to more and they become much more comfortable with technology as well."

In one teacher's opinion, the online tools have added a new dimension to the JASON Project. "Team JASON Online is probably one of the biggest improvements that the JASON Project has made in the last three years. It's a wonderful site. It's easy to navigate around now. Before you had to have the CD ROM, and it often crashed on you. The things that are available for the kids online, the digital labs, Ask the Expert, the archives so they can go back and see what past expeditions are like. The technology is a big part of JASON, and it's so current." This teacher added that because JASON inspired teachers in her school

> *to want to make greater use of technology, the school actually pressed ahead more quickly in developing its technological infrastructure to accommodate them. "The technology committee at first just hooked our rooms up because of the JASON Project. They saw how important that was and how the kids were using it. They pushed and got the Internet connection into the building sooner than it would have been without JASON. When they saw how involved the kids were they really pushed to get it done."*

A principal said that the JASON Project helped teachers in her school, "find uses in their classrooms for [technologies] they didn't use before." Teachers noted that the impact of JASON on technology use extends beyond the classroom. "I've heard parents over the years say one of the main reasons they got the Internet at home was because of the JASON Project. They saw what their kids were learning and they were talking about what they did online and decided to get the Internet."

Even one teacher who has not been able to take advantage of TJO with her students observed that JASON prompted her to use other kinds of technologies in her classroom. "We use video and computers more. They haven't done the JASON Online yet. I've used it. I haven't used it to research sites. But they use things like the spectrascope, the water testing kit, other scientific instruments."

JASON Impact on Student Learning

The JASON curriculum helps students engage in hands-on learning activities; and connect their science learning to real-world issues. As a result, they are able to grasp concretely complex abstract science concepts.

Both teachers and administrators cited the ***hands-on activities*** as the most effective tools in the JASON Project curriculum. They felt the JASON labs, activities, and field investigations held students' interest more than standard teaching methods. According to one teacher, middle school students in particular need a hands-on approach to learning, which fits their learning styles and identities.

> *"These kids need to be actively involved because they have short attention spans. They need something that's going to keep them engaged for a longer period of time. . . . Seventh graders are all over the place anyhow, and just being able to move around is helpful. They can talk while they're working, going here and there. It doesn't have to be teacher-directed all the time. That's what they like and need. We've just seen the excitement." This teacher's principal described a hands-on activity that students were excited about. "Last year when they did the outer-space thing they all got to try to pound a nail in while standing on a boogie board and kids were buzzing about that for days about how much fun that was."*

One teacher noted that by integrating JASON activities into her classes she could reinforce the concepts she was teaching with other forms of instruction and appeal to a diverse array of students.

> *"With hands-on activities not only do they have to put [what they're doing] in writing they have to explain a concept to me or to a group member. They're seeing the concept in so many different ways that it hits every student's way of learning. They all have their own style. Some learn best just by hearing me say it, others learn best if they write it, and others need to actually hold something in their hands and do something. JASON is good because it encourages students to get involved or actually do research on their own."*

Not only did teachers mention that JASON's hands-on projects kept students engaged as they did the activities, they also appreciated the fact that students come away from most JASON activities with a tangible product. This combination is especially effective with students who may otherwise be difficult to reach.

> *"There's something in there that will catch [students], even the student that maybe has no interest in school. We've noticed that the kids come to school and they're involved. When there's things going on involved with JASON they're here. There's something here for them and they'll find it. It may take them a little while, but there's a product produced, and they're proud of themselves when they do that."* A co-science teacher added, *"The special needs kids, they are all accountable for doing that [JASON] research project as well, and you'd be amazed at what these kids can do. It makes them reach."*

Another teacher agreed that JASON's hands-on activities are especially appropriate for the at-risk students she teaches.

> *"[JASON] has a lot of activities, things where you can work one-on-one or with a small group where [the students] can accomplish something. Even just going down to the stream and taking samples and testing it, they can feel good about that. The other week we did a netting to see what water is polluted and what's not, and that all fits in with the JASON Project and learning about the watersheds and water problems.... Just getting them out of the building helps a lot. They like that."*

Apart from the hands-on activities, the other component of JASON that teachers and administrators felt was compelling for students was the fact that each year it allowed students to ***make real-world connections*** by following an actual expedition and seeing science being done by real-world scientists. This makes science more relevant to students, and helps them make connections between what they are learning in school and the larger world.

> *"Last year we did so much work with the international space station," said one teacher. "Anything that they're hearing in the news, they understand. . . .They*

can connect to the real world. School is not an isolated place anymore. That's a big part of JASON. It puts them right out there where things are happening and going on right now. They would go outside at night and watch the space station go by. We'd tell them where it was going to be. They just make connections, and then it goes from child to parent. We see a lot of that at conference time. They're talking about this at home. That means that they're learning something and they feel it's important enough to share."

"It's hard with sixth graders for them to make the connections," another teacher observed. "If they can identify with a scientist and be interested in what that scientist is studying . . . to me it makes it more relevant and more exciting and motivational, knowing that this person used to be a sixth grader and now he's a scientist. Those things get the kids excited."

One principal noted that the exposure to real-world science offered by JASON is particularly beneficial to the students in her school, many of whom are economically disadvantaged and see little connection between what they do in school and their actual lives.

"[JASON] gives them the life experiences that they wouldn't normally have. We have to focus on the basics so they can pass a state, norm-referenced test, but the students have to go out there and work in the real world, so they have to know what careers are out there and how what you learn can apply to what you do in the future. . . . Unfortunately today some schools focus so much on knowledge and comprehension questions that they forget the applied aspects of this type of learning. JASON brings in the applied learning."

JASON gives students different ways to experience the scientific research going on each year. Not only do they see the videos and attend the Tele-presence, they can also talk directly to the scientists online.

"Last year we did a couple of the web chats and the students really enjoyed them," said one teacher. "They saw they were actually talking to the real scientists, having their questions answered. . . . It helps them see that it's real . . . that science is constantly going on. It makes it connect better in their heads."

Some teachers suggested that this kind of contact encourages students to ask good questions. "JASON makes them ask questions," one teacher claimed. "They want to know. Maybe it's the fact that they know that this is a real expedition going on at this time and familiarity with the scientists." Another teacher described how involved her students become in each JASON unit. "One of the practices I use is to write a focus question on butcher paper and put it up, leave it there, and the kids come up and write questions all throughout the unit. At the end of the unit the butcher paper is covered in questions, and that steers me to where I go next. They don't want to stop. They want to go beyond."

According to one longtime JASON teacher, the interest in science that JASON can inspire in students due to the connections they make with real scientists sometimes endures longer than their exposure to the curriculum. Because she has done JASON for so many years, she is in a position to see what her former students are doing. She cites one of her students as an example.

> *"He's a freshman in high school taking sophomore-level science courses and the main reason for that is that JASON got him going. He got perfect scores in his ACT in science as an eighth grader. I remember his question about how dinosaurs became extinct and he researched it and delved into that question. He just got so hooked on science. There's something there for everyone. Everyone's going to get hooked somewhere down the line. I think we had several students go into marine biology because of JASON."*

The common themes above seem to characterize participants' experience with the JASON Project across multiple study sites, and conjoin to provide the impression of a unique JASON experience. The following section describes distinct JASON experiences for students in each school setting across the country.

Site Reports

The data collection at each school site focused on contextual information about school and community, as well as the participating teachers and students. With a total of three visits per school site, we developed profiles of the participating schools, communities, classrooms, teachers, and students.

Lingle Middle School

Rogers, Arkansas

Rogers, Arkansas, the home of Lingle Middle School, is a town of 35,000 in the Ozark Mountains. Rogers is situated in a rural setting, but because it is both the birthplace and the current home of the nationwide Wal-Mart chain, the town has been growing rapidly over the past ten years. The school district serves a population of 70,000, which includes the town of Rogers and outlying communities. Between 1990 and 2000 the number of students in the Rogers Public School District grew by 4,300, to about 11,000, and the district has been struggling to accommodate this larger population. Not only are there more students, but the needs of the students have changed significantly as well. For example, in 1991 Rogers Public Schools had 84 English-as-a-Second-Language (ESL) students. By 2000 that number had grown to 2,615, or 17.4% of the student body.

The Rogers Public School system has two middle schools (grades six and seven) and two junior highs (grades eight and nine) along with eleven elementary schools, one high school,

Observation in December at Lingle Middle School, Rogers, Arkansas

This observation was conducted in the late fall, and the class was just beginning the JASON Project. The classroom is arranged with students sitting at tables for two pushed together to create tables of four, so the students face each other. Around the classroom are posters of animals and aquariums, a computer, a TV monitor, and an overhead projector.

After the students have copied down their assignments from the blackboard, the teacher tells the students they are going to do a KWL chart about volcanoes. She asks the students if they know what a KWL chart is. One student responds, saying that the K stands for what you already know, the W stands for what you want to know, and the L stands for things you've learned. A large sheet of white paper is taped to the blackboard, with three columns, labeled "K," "W," and "L." The teacher asks for volunteers to write down student questions and comments on the chart. The teacher tells the students they can add questions to this chart at any time while studying volcanoes.

and one alternative school. Nine-hundred and forty sixth and seventh graders attended Lingle Middle School in the 2000–2001 school year. The majority of the students are white (73%) but there is a substantial number of Hispanic students as well (20%) and much smaller numbers of Asians, African-Americans, and Native American students. About half the students who attend the school are from the local community, and half are bussed in from neighboring towns. The communities served by Lingle Middle School are generally middle to low income. Forty-two percent of students receive free or reduced-price lunches, a slightly higher percentage than the district overall (35%).

Lingle has a total of 53 teachers, with an average of eleven years of teaching experience. They teach a wide variety of courses. Along with the standard classroom subjects (math, science, language arts), Lingle offers music, art, French, ESL, physical education, and home economics. The school has a gifted and talented program as well as special education, but both GT and Special Ed students attend heterogeneous classes with other students and are pulled out for their enrichment or remedial courses. The average class size in the school is 29 students.

The Rogers public school district generally scores above both the state and national norms on the Stanford Achievement Test (SAT-9). In the year before this study, 61% of Lingle's sixth graders and 60% of its seventh graders passed the complete battery of SAT-9 standardized tests. In an attempt to raise student test scores in reading, Lingle has begun to use the Accelerated Reader program and benchmark test, which is aligned to the state standards. Accelerated Reader is a program in which students work their way through a series of reading levels by reading books and taking short reading comprehension tests on

"Really? That's awesome," says one girl.

The teacher explains that she wants to do the chart so that she will understand what they already know. She will not bother covering that material that they've already learned. She asks who has studied volcanoes before and almost half of the class raises their hands. The teacher asks the students to tell what they already know about volcanoes.

"I know that they erupt," says one girl.

"They have hot lava," says another.

"They formed the Hawaiian Islands," adds a third.

"Two things," one boy offers. "Volcanoes can die, and before lava escapes a volcano it's called magma."

A number of hands go up. One girl states, "Some volcanoes are inactive," and another student adds, "That's the same as being dead."

"Is it?" asks the teacher. "That is a question to put up in the 'want to know column': Is a dead volcano the same as an inactive one?"

Another girl raises her hand. "I know the three types of volcano," she announces with a science book open on her desk.

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computers that are then able to monitor individual students' progress. The state of Arkansas, however, is working to construct a more comprehensive form of school evaluation, which includes standardized testing, performance assessments based on student writing rather than multiple-choice questions, school improvement plans, yearly school updates and site visits every five years. "I think the state is trying to make [the evaluation] a truer assessment of how we're doing," said the principal. "Because no one instrument is going to tell you everything."

The level of parent involvement in the community "could be better," admitted the principal. "I do have an excellent core of PTA moms, and we have watch dog dads who come and spend the day with us, but some people you can't pull in here with rope." The JASON teacher we worked with felt that she could generally depend on parents. "Any time I need parents to help out with something, usually I can get enough volunteers, or parents donate materials."

Lingle classrooms each have from one to two computers. There is also a computer lab with about 30 computers, and the library has computers as well. During her interview, the principal reported that she had "just ordered 24 more computers this morning." All the computers at Lingle are connected to the Internet and, according to the principal, the school receives excellent technical support. "We're fortunate. We have an extremely intelligent technology director who was a teacher years ago. So not only does [he] know the technology, but he knows how to use it in the classroom. Every kid in our school has an account [on the server]. Every student in our district does."

"Did you know that before you came into class today?" asks the teacher.

"Yes," the girl replies, "but I had to make sure in the book." She then lists the types—shield, cinder cone, and composite—"like Mt. St. Helens," she observes. She also reports that the shield volcano erupts quietly, the cinder cone erupts loudly, and the composite can be quiet or loud.

The teacher now asks the students what they want to know about volcanoes.

"Why do volcanoes erupt," one girl asks, "and how often?"

"Can rain on lava cause mudslides?" one boy suggests. "I just saw something about that on a National Geographic Special."

"Then it must be true," one girl responds.

A boy offers another "Know": "When there's an eruption the volcano grows."

"Can a person get stuck in lava?" asks a girl.

"Something I "Know" and something I "Want to know," says a boy. "Eruptions vary on a volcano. What I want to know is, if lava destroys everything, can anything survive? And what causes the pressure that causes a volcano?"

Arkansas has created its own standards, called "Essential Learnings," and in the fall of the 2000–2001 academic year, devised Essential Learning frameworks for science. The state frameworks for middle school are written for grades 5 through 8. "That's a pretty big span," said the principal. So the district decides "what it is we expect our children to learn at certain grade levels . . . what needs to be done grade by grade."

Lingle Middle School has been involved in some way with JASON since it opened five years ago. "This is my third year [with JASON]," said the teacher who participated in the study. "One [teacher] team has been involved with it for all five years Lingle has been open. For two years we didn't have the money for all of us to be involved with it so [the principal] had to pick and choose" which teachers would participate. At this point, however, all of the sixth graders in both of the district's middle schools participate in JASON, so the program, taught by six teachers, reaches 600 students at Lingle each year. However, not all of the teachers receive JASON training each year. "This year I didn't go to the workshop," said the teacher in the study. "Out of the five sixth-grade science teachers, all are new except for two of us, so all the new teachers were allowed to go." The gifted and talented teacher in the school is a JASON trainer, which means that she is able to provide all of the teachers with the JASON materials as well as support as teachers try to integrate them into their curricula.

The JASON teacher in the study adapts JASON to meet the needs of her classroom. "I have the standards in the back of my mind, and as I look through the curriculum I just pick and choose things that make easy connections with what I need to cover over the year.

The students are now excited and are talking a lot among themselves. "I think I know the answer to one of the questions," claims one boy. "The span between eruptions depends on how much magma is building up."

"How long does a volcano live?" one girl asks. "Can animals live in a volcano after it dies?"

"Why is magma in volcanoes and not mountains?" offers another girl.

"I have three questions," says another girl. "How hot is lava? Does magma have cells? How does magma reform in a volcano after it erupts?

"Is lava helpful to our environment?" one girl asks. "Do we need lava?"

"That's a great question!" the teacher says. "I don't think anyone has asked that in all my classes."

"One of the most popular eruptions is Black Sunday," states one boy. "And there is something called the Ring of Fire in the Pacific. I'm not sure where exactly."

"Let's make that a 'Want to know,'" suggests the teacher. "What is the Ring of Fire?"

A girl asks, "Can we go to the Ring of Fire for a field trip?"

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Then as I cover those topics I pull JASON topics into it, or this year I may do a big JASON unit, but then keep pulling from it the rest of the year." Although only the science teachers receive JASON training and the curriculum, the sixth grade attempts to make JASON an interdisciplinary program. "My team of teachers . . . will sit down together and look through the curriculum and see what we can cover that ties in to the Essential Learnings," explained the JASON teacher. "Once you have the time to sit down and go through it it's easy to figure out how to use it."

"Not this year," the teacher laughs.

"Are geysers and volcanoes related?"

"You mean like Old Faithful?" says the teacher.

"Why is lava called magma inside a volcano?" one student asks, and some of the students offer different answers to this question.

"That's it for now," says the teacher. "You can add to K or W later. Some things in the Know column are true and some are not quite true. They may be rumors."

The teacher then tells the kids to pull out a piece of paper and put a heading on it. She turns on the overhead and asks the kids to raise their hands if they know the definition of a volcano. The students offer different definitions. The teacher shows them her definition on the overhead and the students write it down. "Do we have to copy it directly?" asks one girl.

"You can put it in your own words as long as the meaning is the same," the teacher responds.

The teacher then asks a boy what the difference between magma and lava is. He tells her, and she asks him to write this down on the overhead. "We only have three minutes left," notes the teacher. She tells the students to fold their papers in three and then asks, "What were the three types of volcano?"

"Silicone?" one boy suggests.

"No," replies the teacher.

"Shield?" says one girl.

"Cinder cone," offers another.

"What's the third?" asks the teacher.

"Composite," a third girl responds.

The teacher has the students write these three types in the different columns on their paper. As the period ends, she has the student volunteers carefully remove the KWL chart from the black board and put it away.

Southridge Middle School

Fontana, California

Southridge Middle School is in Fontana, California, a suburb about an hour east of Los Angeles and a few miles west of San Bernadino. Fontana Unified School District (FUSD) is large, with 38,000 students and 33 schools, six of which are middle schools. Fontana is a low-income community with a population of 140,000. Sixty-seven percent of students in this district receive free or reduced-price lunches. Southridge, however, is a predominantly middle-class neighborhood within the city of Fontana, with 38% of students receiving free or reduced-price lunches. Southridge receives Title I assistance for 475 of its students.

Southridge Middle School covers sixth, seventh, and eighth grades. During the 2000–2001 school year 1,279 students attended the school: 435 sixth graders in 14 classes, 443 seventh graders in 12 classes, and 401 eighth graders in 11 classes. The ethnic make-up of the student population is majority Latino (58%) but there are considerable numbers of white students (19%) and African-American students (13%), along with smaller numbers of Asian students (2%), Native American students (1%) and students designated as "other" (7%). About 18% of students are identified as "limited English proficient." The principal described Southridge as primarily a "walking school." Most of its students (1,159) are from the surrounding neighborhood. Two buses transport 120 of its students from outside the immediate community.

Southridge has 52 full-time teachers, 7 of whom are special education teachers and 10 of whom teach physical education and electives. The faculty is young, averaging 7.8 years of

Observation in December at Southridge Middle School, Fontana, California

This teacher integrates a JASON activity into his class—the activity that uses film canisters, some with holes in the top and others without, to illustrate two kinds of eruptions. This class is the most crowded of any we observed, but the students are well-behaved, so the class does not get out of hand. The students sit at tables in groups of three or four.

After the students settle down, the teacher asks them to name the different kinds of lava, and also asks about the instruments that scientists use to study volcanoes. The students offer different names for types of lava—a'a and pahoehoe—and different instruments, including thermometer, video cameras, radar guns, and the Global Positioning System. The teacher then asks, "What did the scientists in the JASON video put underground to check on the lava?"

"A gopher," one boy responds, and everyone laughs.

The teacher then puts up an overhead that

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teaching experience, and 20 of the school's 52 teachers are untenured. Class sizes average about 34 students. Except in some special education classes and a few math classes, Southridge students are not tracked by ability.

Southridge scores in the 40th percentile on the Academic Performance Index (API)—a standardized test used in California. This is below the state average but, according to the principal, these results represent "the highest API scores in the district," and the scores have been improving steadily over the past three years. The JASON teacher we worked with told us that "about 75% of our kids are reading below grade level." Test score data corroborate this comment, with Southridge seventh graders (the age-level we studied for the JASON evaluation at Southridge) scoring in the 32nd percentile on the SAT-9 reading test. Students in the other grades scored somewhat higher on the SAT-9 reading test, with sixth graders in the 39th percentile and eighth graders in the 45th percentile.

The JASON teacher observed, "We live in an area where education is not stressed by the parents very much. . . . There's very little parental involvement. . . . A lot of our kids are taking care of little brothers and sisters. They don't do homework on a regular basis." The principal argued that Southridge parents were more involved than parents at most of the districts' schools. However, she agreed that some of the students' living situations made it difficult for them to get work done at home. "We have students whose parents are in jail and they're living with their grandmother. We hold the students accountable for the six hours that we have them and do everything that we can in those 6 hours. If teachers do give homework it should just be one or two things to reinforce the concepts, because some of the homework, like algebra, the parents don't have a good understanding of it, so we'd

reads "The Eruption Lab." He explains the activity they will be doing that day and what materials they will use. "How do we start a lab?" he asks.

A boy replies, "With a hypothesis."

"Which will have a better eruption, the canister with a hole in it or one without? Talk with your group and form a hypothesis." The kids talk quietly to their groups and write down their hypotheses.

"After the hypothesis," says the teacher, "what comes next?"

A number of students respond at once. "An experiment."

"What do you need for an experiment?" he asks.

"Materials," the students reply.

"What materials?"

"Two film tubes," they answer.

"What else?"

"Alka Seltzer."

"What else?"

"Food coloring."

"Why is it red?

"To look like lava!"

be penalizing those students for not doing their homework because they can't get help."

Southridge has invested a fair amount of money over the past few years to improve its technological infrastructure. As of 2001, there was at least one computer in every classroom, 36 computers in the school's computer lab, and 36 computers in the library. Most of the computers have Internet access, and every classroom has five to six Internet drops, though rarely are there enough computers in a classroom to take advantage of all of these connections. The principal noted that technical support was a problem in the Fontana School District. Although a support person is specifically assigned to her school, she only has access to him two days per week. On the other three days technical support problems either have to be put on hold or teachers and staff need to solve the problems themselves.

Although there are California state frameworks for middle school science, the Fontana Unified School District does not have set science standards. The district has a textbook, but, according to the principal, "It's not a strong textbook and it doesn't hold the interest of the students." The JASON teacher admitted, "I hardly ever use the book for anything. I just get my ideas from it."

In the 1997-98 school year, the assistant superintendent introduced the JASON Project to the district, and as of last year the district decided to make JASON a mandatory part of the core curriculum for all sixth graders. All sixth grade science/math core teachers in the FUSD attend JASON workshops (which is paid for by the district) and all sixth grade students attend the Tele-presence. Teachers in other grades (fourth, fifth, seventh and eighth) can choose for themselves whether to participate in the JASON Project. The district

The teacher holds up his stopwatch. "What's the last piece of equipment needed?"

"A stopwatch," the students reply. As they answer the teacher's questions, the students write down the materials they need for their experiment.

"You're going to record how long your eruption takes," says the teacher. "You should time the eruption until the cap pops off. There are four simple steps to the lab." He explains that they have to fill the canisters halfway with water, put the Alka Seltzer in, put the top on and then record how much time it takes for the cap to pop off. As he is talking the students are writing down the steps of the lab.

"What do we immediately do after the Alka Seltzer step?" he asks. "You put the lid on and start timing. Step four is to repeat steps one, two, and three with the second film tube. Observation is important in this lab. What is the important observation you will make?"

"How long the eruption takes," says a boy.

"And see which eruption is bigger," adds another.

"We're going to do the canisters with the

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purchases all of the JASON-related materials needed for labs and activities, and students are supplied with a JASON booklet containing material from the JASON curriculum.

Overall, there are [about] 16 JASON teachers at Southridge Middle School, 8 in the sixth grade, 4 in the seventh grade and 4 in the eighth grade. Both the principal and the JASON teacher estimated that between 900 to 1,000 of the school's 1,279 students were involved with JASON that year. Other than students who enter the school after sixth grade, all of Southridge's students should be exposed to the JASON Project at least once in their middle school careers. Two students from Southridge have gone on to become Argonauts which, according to the principal, "was just awesome. It gives [the students] the motivation. . . . This year we had eight students who wanted to go through with the application process."

The JASON teacher participating in our study has been involved with the JASON Project for four years, during which he has consistently used the JASON curriculum for the eight weeks leading up to the Tele-presence. Each year he has also attended the training session. For the most part, this teacher uses JASON materials to find interesting, hands-on activities that enhance his regular science curriculum. "The thing that I like about [JASON] is that they have really good ideas for labs. . . . I look for labs that bring about conversations." Along with the labs and activities, this teacher uses the JASON booklet and the introductory video in his class. He mentioned that he has logged onto the JASON website on his own a few times but does not generally have his students use the website or participate in Team JASON Online activities as a part of the JASON experience in his classroom. However, his students did use the website to conduct research for their final projects.

Due to budget cutbacks the Fontana Unified School District cut its funding for the JASON Project curriculum after the spring of 2001.

holes in them first. One person from each group pour water into the tube. Another person grab a stop watch." The students get up from their tables and gather the materials efficiently from different areas of the classroom. They sit back down with the watches and Alka Seltzer and half-full water canisters. The teacher tells them to get ready to start the experiment. The students drop the Alka Seltzer tablets in the canisters and quickly put the tops on. "On your mark, get set, time!" yells the teacher. One top pops off very quickly. The kids laugh. The teacher walks over and looks closely at the top that popped off. "It didn't really have a hole in it," he says.

Another boy calls out. "Nothing happened! Ours is just making bubbles."

"If it didn't erupt, that's part of your observation," the teacher replies. "What did happen?"

One group had a small hole, which creates a lot of pressure. The liquid comes out in spurts. The teacher remarks, "If they had been research scientists, they would have been sprayed with hot lava." Most of

the groups, however, just have the liquid ooze out of the canister. They write down this observation.

"How many think that the tube with the hole has the bigger eruption?" the teacher asks. No hands go up. "How many think that the tube with no hole has the bigger eruption?" All of the students raise their hands. "Why is that?"

"The pressure builds up," the students answer.

"What if there's a hole?"

"Lava can ooze out or bubble out," they reply.

"What if the hole is small?" he asks.

"The lava comes out like a geyser," says one boy.

One girl observed, "We had smooth lava today."

A boy says, "Ours didn't bubble out at all."

Another boy asks the teacher, "Does it matter how much water and how much Alka Seltzer?"

"Yes, it does," the teacher answers. "More Alka Seltzer will make it bubble more."

There is not enough time in the class period for the students to do the experiment with the film canisters without holes, so the teacher tells students they will pick up where they left off the next time they meet.

Farms Intermediate School

Hartland, Michigan

Hartland, where Farms Intermediate School is located, is a small town about an hour's drive northwest of Detroit, Michigan. Farms is the one intermediate school (grades 5 and 6) in the Hartland Consolidated School District, which also has three elementary schools, a middle school (grades 7 and 8), and a high school. The Hartland School District serves 4,228 students. The community of Hartland is primarily middle to upper-middle class, with a median income of $53,000. Only 3% of students in the district are eligible for free or reduced-price lunch.

Farms Intermediate is three years old. During the 2000–2001 academic year Farms had a total of 741 students, and all of the students are from the local community. The ethnic makeup of the school is overwhelmingly white (98%). The school does not track for ability. Farms has a total of 40 certified teachers, making the student-teacher ratio 18.2 to 1. Many of the teachers are relatively new to teaching, with an average of 8.6 years of teaching experience. The average class size is 26 students. The teachers teach in teams of two or three, so teachers are often responsible for teaching more than one academic subject, and can also share the teaching responsibilities of a single subject. For example, one teacher on a team may teach the biological and another the geological part of the science curriculum. Students rotate from one teacher to the other throughout the day, and the daily schedule is very flexible. The teacher teams decide for themselves how to parse out the day, and schedules can be modified in order for students to engage in extended activities.

Michigan students are tested in different grades on a variety of subjects using the Michigan Educational Assessment Program (MEAP) test. In fourth and seventh grade students are tested on math and reading. In fifth and eighth grade they are tested on science, writing and social studies. There are no MEAP tests given to sixth grade students, the grade that participated in this study. The tests are scored differently, with reading and math scored as satisfactory, moderate, and low; science scored as proficient, novice, and not yet novice; writing scored as proficient and not yet proficient; and social students scored at levels 1 through 4, with 4 being the highest. The year 2000 MEAP results for students in the district were as follows: on the math test fourth graders were 75% satisfactory, 16% moderate, and 9% low; seventh graders were 63% satisfactory, 23% moderate, and 14% low; in reading fourth graders were 58% satisfactory, 27% moderate, and 15% low; and seventh graders were 48% satisfactory, 31% moderate, and 21% low; on the science test fifth graders were 63% proficient, 36% novice, and 1% not yet novice; and eighth graders were 27% proficient, 64% novice, and 9% not yet novice; in writing fifth graders were 90% proficient and 10% not yet proficient; and eighth graders were 80% proficient and 20% not yet proficient; and finally in social studies 71% of fifth graders scored at the two higher levels, while 55% of eighth graders scored in the two higher levels. Although these scored are generally quite high, there is a marked decrease between the fourth and fifth grade scores and the seventh and eighth grade scores in all areas.

Farms Intermediate has two computer labs and a media center, and some classrooms have computers in them as well. Overall there are 112 computers in the school. All of the lab and

media center computers have Internet connections, and seven of the classrooms do, including that of the teacher who was the focus of this study. This teacher said she was using the technology in the school to take advantage of what the JASON Project had to offer online. "I'm constantly using [technology]," she said. "We use the JASON digital lab, the JASON site; we do Team JASON Online. Each kid has been issued a password to set up their own account. They write in the online journals. They do research through the JASON site. They have nice links. I feel safe using their site and the kids like to go there and see what's going on. They can interact with the scientists out in the field. We use the chats. Our goal for this year is that everyone walks out with their own web page. Some will use their JASON projects for their sites."

The JASON Project was brought into the school by the teacher who served as a participant in this study. She has been a part of the program for five years, and when she came to Farms Intermediate three years ago she was already involved as a JASON trainer. "I do four to five trainings a year for the state of Michigan where I train teachers in the JASON curriculum. I train the Upper Peninsula teachers in the summer." Because she is a JASON trainer, this teacher attends the National JASON conferences each year through the support of her PIN site. "The trainings are excellent. They give you a lot of hands-on activities in how to implement activities in your classroom. You leave there really knowing how to teach this curriculum." Other teachers in the district, however, have to pay out of pocket to attend the national training conference. This teacher is acknowledged as the JASON leader in the school.

The students in the district attend the Tele-presence at the district high school, although the high school does not participate in JASON. For the most part only the elementary schools and the intermediate school participate. In the principal's view, "Once people become departmentalized [in the middle and high schools], and they start teaching the state's curriculum without integrating with other classes, then I think JASON loses its effect." At Farms the JASON Project is used as an interdisciplinary program, with teacher teams integrating the materials into a variety of subjects. "JASON helps me incorporate all the disciplines into science," said the study teacher. "It ties the past to the here and know, where we are, and to the future, where we're going."

The study teacher and principal estimated that from six to eight teachers in the school use JASON, reaching approximately 390 students. More of the sixth grade teachers use the program than the fifth grade teachers. Both the principal and the teacher in our study believed that was because the sixth graders do not have to take the MEAP tests, which gives the sixth teachers more flexibility in their teaching. Although they do not have testing, as the study teacher noted, "We have a curriculum that's mandated by the state and we also have a curriculum in our school district that we have to meet." However, in her view this does not prohibit her from using JASON. "The one thing about JASON is that it already hits our state curriculum, it hits the benchmarks. I have never taken the curriculum and taught every single lesson. I probably never will. It's too much. You pick and choose activities that you can connect to your state curriculum, making sure you hit your district benchmarks."

West Hempstead Middle School

West Hempstead, New York

West Hempstead Middle School is in West Hempstead, a suburb of New York City in the densely populated western half of Long Island. The school is one of four schools (two elementary, one middle school and one high school) in the West Hempstead Union Free School District, and is located in the same building as the high school. The district is small, with a population of 2,278 students. The community of West Hempstead is economically and ethnically heterogeneous.

In the 2000–2001 academic year 498 students attended West Hempstead Middle, which covers grade 6 to 8. The student population is quite diverse. Sixty-three percent of the students are white, 16% Hispanic, 18% African-American, and 3% Asian-American. Only 7% of West Hempstead's students are eligible for free or reduced-price lunches. About 2.5% are identified as limited English proficient, and 4% are identified as having physical or learning disabilities. The spending per pupil, at $13,200 per year, is by far the highest of all the schools in the study and exceeds the second-highest spending rate (Wisconsin) by almost $5,000 per student.

West Hempstead has a total of 35 full-time and 15 part-time teachers. The teaching staff is very experienced, with an average of 20 years of teaching experience. The student-teacher ratio is 13 to 1, and the average class size is 26. Except for honor classes, students are heterogeneously grouped. The teacher who participated in this study described the atmosphere of the school as the "kinder and gentler middle school." The principal articulated West Hempstead Middle School's philosophy as "helping students make it through this difficult time in their lives; socially and academically."

All students in West Hempstead Middle School take standardized tests, but the eighth graders are tested most heavily in English, language arts, math, science, and technology. The school generally scores above the statewide average, in the middle range for the region, and slightly below the rates for similar schools (with similarity determined by the percentage of limited English proficient students and students eligible for free or reduced price lunch). The tests are scored at four levels, with 1 being the lowest and 4 the highest. On the year 2000 English language arts test, 5% of West Hempstead's eighth graders scored at level 4, 44% at level 3, 44% at level 2, and 6% at level 1. On the math test, 13% of the eighth graders scored at level 4, 49% at level 3, 31% at level 2, and 8% at level 1. It should be noted that the year 2000 math test results reflect a dramatic increase from the 1999 math results, in which 8% of eighth graders scored at the highest level, 32% at level 3, 37% at level 2, and 24% at the lowest level.

The teacher who participated in this study has worked in the West Hempstead School Union Free District for 28 years. She described the community as "typically suburban," ranging from low-middle to middle to upper-middle class, but with a predominantly Jewish

population. Many of the conservative Jewish students are sent to yeshivas rather than the public school, and many other children of wealthier families are sent to Catholic schools. Thus a large segment of the resident population, particularly those in the upper-middle class, does not attend the area public schools. She did remark, however, that if they did choose to go to the public schools, there would be no space to accommodate them. According to this teacher the first wave of minority students were from "solid middle-class" families, but now many of the students come from families that are "more transient" and less "educationally oriented." Over all, the socioeconomic status of the families of students who attend the school has dropped, particularly within the past six or seven years.

There are 100 computers located in a lab, the library, and in classrooms at West Hempstead, all of which are connected to the Internet through a T1 line. The computer lab, the principal admitted, is equipped with outdated computers purchased six years ago. There are generally two to three computers in every classroom, although the study teacher did not have any computers in her room. Her science classroom did, however, have microscopes, chemical cabinets, and access to the science supplies at the high school. The teacher described her science class as being "rich in resources."

In the principal's experience, the New York State benchmarks heavily influence how student achievement is assessed. Currently there are mandatory eighth-grade state tests, and soon there will be a sixth grade test modeled after the eighth grade one. This is the first year of a mandatory eighth-grade state test. In the view of the study teacher, teachers are pressured to teach toward the test because the local newspapers publish the results. She recalled that the first time the math tests were administered, students did not perform well (as mentioned above). This translated into pressure being placed on the department to get those scores up. She added that "it does horrible things to learning" and diminishes the quality of life for the kids at the school, which becomes "an oppressive place." The kids who score poorly, for example, must give up art to attend remedial classes. The most vivid effect these tests have on teaching is that, according to the principal, from mid-May to the end of June there is little content education going on. Most of the instruction experienced by students is geared toward preparing for testing. This, he believes, "has no wisdom . . . school has to be a place where they want to be."

JASON has been part of the science program at West Hempstead Middle for four years, ever since the study teacher learned about the program at an in-service oceanography course. A staff member at Nassau County BOCES (Board of Cooperative Educational Services), the JASON PIN site in that area, described the curriculum to her and she in turn encouraged her school to get involved with JASON. The program is now used by the three sixth-grade science teachers and reaches about 180 students each year. Except for one year when a language arts teacher integrated one of the JASON books into her curriculum, sixth-grade science teachers are the only ones in the school involved with JASON. The principal, in fact, questioned whether JASON would persist in the school, since two of the three teachers who now use it were due to retire (including the study teacher).

Nassau BOCES hosts the Tele-presence and runs a five-day summer workshop for JASON teachers in the county. The JASON program receives significant support from the district, which offsets the costs for the Tele-presence and field trips. According to the study teacher, the district superintendent was convinced that JASON was a good program. Now JASON has a project line of its own in the district budget of $4,000, which covers mostly trips. The district uses the community newspaper to publicize their JASON field trips, and the school's science fair projects are connected to JASON activities.

West Elgin Elementary

LaRue, Ohio

The most rural of all the sites we visited, LaRue, where West Elgin Elementary is located, is a very small town surrounded by farms and the flat, open country of central Ohio. The Elgin Local School District, with a total student population of 1,738, has four schools—two elementary (K–6), one junior high (grades 7 and 8), and one high school. The district encompasses the village of LaRue (population 850) and families living in four other surrounding communities, covering an area of 164 square miles. The community is constituted mainly of working and middle-class families.

Elgin West Elementary (K–6) had 418 students in the 2000–2001 academic year. The average number of students per grade is about 60. Ninety-six percent of students are white; 4% are either multiracial, Hispanic, Asian or Native American. A fairly large number of students (36%) are eligible for free or reduced-price lunch, and 16% of students are identified as having physical or learning disabilities.

Elgin West has a total of 27 full-time teachers—19 regular education, 3 special education, and 5 special area teachers. They have an average of 10 years of teaching experience. The student-teacher ratio is 19 to 1, and the average class size is 21. Along with the general education subjects, Elgin West students take art, music, and physical education. The school also has a Title I program for reading and math. Although the school has both a gifted program and special education services, students are not tracked in science or social studies.

Observation in January at West Elgin Elementary, LaRue, Ohio

The classroom is full of live animals (frogs, bugs, worms, birds, a tarantula, and a snake) in cages and tanks as well as animal specimens in jars, posters of biomes, human anatomy, and different kinds of energy systems. Groups of three and four students sit at small work/lab tables. A boy talks to a cockatiel as it perches on his hand.

The teacher opens the lesson with a question, "What kind of biome do we live in?"

A student replies, "The deciduous forest."

"That's right," says the teacher. "We get approximately 40 inches of rain a year. That determines the type of plants that grow and that determines what else?"

"The animals that live here," says another student.

"What about Hawaii?"

"It's a tropical rainforest," a student answers.

"It's an ocean type," replies another.

"Temperate?" suggests a third.

"Tundra?" asks another.

"Well what is different between us and Hawaii?" the teacher probes. "Where do the winds come from in Hawaii?"

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The class that participated in our study was a heterogeneous group. The K–4 students have one main classroom teacher while the fifth and sixth grades are departmentalized.

Fourth and sixth graders in Ohio take state standardized tests in citizenship, math, reading, writing, and science. In 2000, 54% of Elgin West fourth graders passed the citizenship test, 44% passed the math test, 63% passed the reading test, 87% passed the writing test, and 39% passed the science test. In the same year 71% of eighth graders passed the citizenship test, 65% passed the math test, 57% passed the reading test, 78% passed the writing test, and 65% passed the science test. It's notable that, compared to the state averages, West Elgin fourth graders score about 5 points lower on the science test, while West Elgin sixth graders score about 10 points higher than the state average on the science test.

According to the principal, "This is a rural area but most of the children do not live on farms. I'd say maybe 5% of the students actually live on farms. The rest live in little subdivisions in houses scattered throughout the county." There are a number of industrial complexes in the area, where many members of the community work. "I think it's a very supportive community," said the principal. "I think they are concerned about their children's education and that's supportive in my estimation. In the village itself, they have done things like create an after-school program in the local churches where the kids who don't have a place to go after school can go." The principal added that Elgin West has also become a full-service school, "where we have literally tried to open our doors to our community and make the school the center of the community. . . . We offer health screenings for our seniors. We have groups come for aerobic classes and things like that. . . . It used to

"The east."

"The northeast," the teacher corrects. "There are also mountains in Hawaii."

The teacher draws an illustration on the board and explains that on the windward side of the mountain there is a lot of rainfall, so that side has a tropical forest biome. The other side of the mountain does not get as much rain and therefore that area is much dryer, perhaps desert-like. Because of its altitude, there is also the possibility that areas on the mountain can be classified as tundra.

"The whole point of this is that biomes determine climate and climate determines the life that exists in those areas," the teacher explains. "Taking the honeycreeper as an example, there are 40 different types of honey creeper birds. How can this happen?"

"Because the biomes make them have to adapt," offered a student.

"In what way?"

Students suggest feathers, beaks, swimming. The teacher draws a bird with a small, pointy beak. She explains that this beak would be good for eating seeds. "What if the birds had to eventually eat bugs?" she asks. "What would their beaks need to change into?"

be that it opened at nine and locked up at four. Now we have things going on before and after school all the time."

There are 96 computers in Elgin West Elementary, with four computers for each homeroom and additional computers in the special subjects rooms, the special education room, the administrative offices, "even in the gym," said the principal. There are no computer labs in the school. "When the state provided us with a lot of the money for these computers," said the teacher who participated in the study, "we were mandated not to have a computer lab. Ohio didn't believe that that was the way to do it. So we were not allowed to make a computer lab with these computers. They had to go into individual classrooms. Now I think a lot of people are starting to feel the other way about it." The teacher herself believed that she and her students would benefit from having a lab. "I really felt that was the way to go to have a lab set up and have the kids go in and have every child have a computer and a teacher teaching the whole room." All of the computers in the school are connected to the Internet via a T1 line. "The state of Ohio had something called 'school net' a few years ago," the principal said. "All the schools in Ohio have Internet connectivity. . . . Every classroom and office has an Internet connection."

In addition to having four computers and Internet access in her classroom, the study teacher has a wealth of other resources. "We have a TV and VCR for the grade. I have a lot of resources in all the different areas. I have different chemicals and glassware. I have electrical components, working with electricity. I have a lot of different rock samples to use. I have microscopes, hand held microscopes, aquariums. I have an extensive video collection. I have equipment that I've gathered up free from different businesses and things;

"Pointier," one student replies.

The teacher draws a beak with a pointier beak. "What if they had to only eat nectar?"

"It would need to be long and curved?" suggests a student.

The teacher draws that beak shape on the board. "Now you're going to become birds!" The class is going to do the JASON Bird Beak Brunch activity. The teacher tells the students to work in groups of threes to find out what it is like to be a bird with a certain kind of beak. She draws a grid on the board and tells the students that they will be recording the data they collect in this grid.

Each student in each group has to select whether they are seed, insect, or nectar eaters. They are given seeds, rubber bands (to serve as insects), and water (nectar). Each student lifts these from one cup into a second cup using only the tools that assigned to them. Seed eaters have to use tweezers, nectar eater use straws, and insect eaters use toothpicks. Each group has 30 seconds to try to move each kind of food (i.e., seeds, rubber bands, water).

Students quickly take their tools and begin moving items from one cup to the other, racing to see how many they can get in before the teacher calls 30 seconds. Students laugh a great deal.

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Styrofoam, foil, seeds. I have my plant light over there. I have a library, different books that I use on subjects. I have a worm farm. I have a unit that I do on composting. It's full of red worms. We throw in lunch samples every so often. The worms we use to feed the turtles and the snakes and the frog. It's an ecosystem for sure. Kids are always bringing in different things especially in the spring and fall."

The school's curriculum is dictated by the material on the state's standardized proficiency tests, the scores of which are publicized in the newspapers each year. "We are allowed local control but we're not allowed local control," said the principal. "If we don't tweak our curriculum to match what they want on these proficiency tests we're not going to do real well in terms of public image even though our students might be very capable." In order to perform well on these tests, a committee of teachers in the county works to align the curriculum with the state standards. "They work with the County Curriculum Director," the principal said, "and they develop the curriculum and upgrade it every five years . . . so that we cover all the outcomes that the state expects us to cover. . . . Right now all the curriculums are pretty much in line with the state proficiency test." Along with the state mandated tests in fourth and sixth grade, Elgin West also administers its own test to students in the other grades to make sure they are performing at grade level. "We also administer the Iowa test, the basic skills at the third grade level and we administer the Metropolitan Reading Readiness Test in kindergarten. . . . In terms of assessment, we're constantly assessing."

The JASON Project was introduced to the school three years ago by the PIN site coordinator at the TriRivers Educational Computer Association (TRECA). In the first year, the study teacher was the only one who volunteered to participate. "It was just our own choice, whoever wanted to go and take the training," she recalled. "It was offered to the whole school." In the 2000–2001 academic year two Elgin West teachers attended the local JASON training—the study teacher and the sixth-grade math teacher, who was new to the school. Because the study teacher is the only science teacher for the fifth and sixth grade at

The results are tallied on the grid:

	Seeds	*Nectar (water)*	*Insects (rubber bands)*
Tweezers (seed-eaters)	65	1.5 ml	68
Straws (nectar-eaters)	13	40 ml	37
Toothpicks (insect-eaters)	3	0.5 ml	43

the school, all of Elgin West's students are exposed to the JASON curriculum for two years in a row.

This year Elgin West was involved in two special JASON events. First, instead of going to the PIN site for the Tele-presence, they connected to the live broadcast right from the school. "When I told them this year that they weren't going to TRECA, they were a little disappointed," said the teacher. "But I said, they're coming here. I think the remark that got to me the most was from one sixth-grade boy who said, 'Why in the world would they choose just a little cow town like this to come to live? What do we have to offer?' I said, 'You know, anybody can do anything. It doesn't have to be just the big city schools that have all the opportunities.'" The second big JASON event involved the study teacher's students connecting over the Internet with a fifth grade JASON class in Hawaii. Each class gave presentations about their own states to the other class. This project encouraged all of the other subject teachers in the sixth grade to participate in JASON activities, so the students would have a diverse array of materials to present to the students in Hawaii. In addition to all this, the study teacher and her husband "celebrated our twenty-fifth wedding anniversary this year and we've planned for twenty-fifth years to go to Hawaii on our anniversary. So we're going to Hawaii in March of this year during spring break. Hopefully I'm going to go into this fifth grade classroom that we're going to connect with and see it first hand. I also want to go on that helicopter tour and dip down into the volcano. Then we're going to climb the volcano and bring this information back to my classroom."

The teacher asks the students to analyze this information. "What beaks are better adapted?"

"Seed beaks could eat more different kinds of food except for nectar," one student observes.

"Insect beaks can only really eat insects," adds another.

"Nectar beaks can eat some seeds, insects, and nectar," another says.

The teacher then assigns the class homework—a JASON ditto that asks students to match beak types with possible food sources.

John P. Turner Middle School

Philadelphia, Pennsylvania

The John P. Turner Middle School is located in southwest Philadelphia, not far from the University of Pennsylvania. The Philadelphia City School District is large, serving 207,465 students who attend 259 schools. The community surrounding Turner is economically disadvantaged and predominantly African-American.

Turner Middle School, which covers grades 6 through 8, has a student population of 1082. Almost 100% of the students are African-American, and nearly all of Turner's students are eligible for free or reduced-price lunch. Turner is a schoolwide Title I school, with Title I reading, writing and math programs. Most of the students (950) live in the local community.

There are 42 full-time teachers at Turner Middle School, making the student-teacher ratio 23:1. The average class size is 31. The school is organized into what the school calls "small learning communities" of 300 students. There are four of these communities, and each has a specific theme: Art and Music, Community and Environmental Studies, Health and Nutrition, and Science and Technology. All of the students still receive instruction in the general subjects, but each community uses its theme to provide a framework for the educational activities. The school in general uses a service learning model, which means that teachers try to focus on issues in the local community and projects are often based on making positive changes in the community. In addition, the school receives a good deal of support from the University of Pennsylvania, which provides professional development for Turner teachers and has programs for the students.

The test scores at Turner are quite low, although comparable to scores in the overall school district. Turner eighth graders are administered the SAT-9 standardized tests in math, reading, and science. In the 1999–2000 academic year, less than 1% of Turner's eighth graders scored at the advanced level on the reading test, 13% at the proficient level, 41% at the basic level, and 40% below basic. Six percent of the students were not tested. On the math test none of the students scored at the advanced level, 2% scored at the proficient level, 16% at the basic level and 66% below basic; 16% did not take the test. On the science test none of the students scored at the advanced level, 3% scored at the proficient level, 23% at the basic level and 61% below basic; 13% were not tested. Turner students also take the Pennsylvania System of School Assessment (PSSA) test. On the math portion of this test, none of the eighth graders scored at the top level, 36% scored in the middle and 64% scored at the bottom. On the reading test, 2% of eighth graders scored at the top, 34% scored in the middle and 64% scored at the bottom. On the PSSA writing test, administered to sixth graders, none of the students received "Excellent" scores, 13% received "Good" scores, 49% received "Fair" scores, 32% received "Weak" scores and 4% received scores of "Poor."

The state of Pennsylvania evaluates schools using a performance index (which takes into account student attendance, teacher attendance, report card grades, and retention) and test scores. The state requires all schools to administer the PSSA test, and the Philadelphia City School District requires the SAT-9 tests. According to the principal, the school struggles more with the district test than the state test, because the SAT-9 is writing intensive. "It's a matter of making sure that teachers teach problem-solving. For problem-solving, they have to write. A lot of times the students know the answer but writing it out thoroughly is a different thing."

The assistant principal noted that there is little parental involvement in the school. "Most middle schools are lacking that. It's a mind-set. The elementary schools have community involvement. It gets to a point where the parent thinks well, they're in middle school now, they're OK. It's really the opposite." The teacher who participated in the study estimated that about 10% of parents are involved in her classes. "Some come on the field trips. Some help set up the computers or work on the projects or just sit in on the classes." Her teaching partner added, however, that "We get a lot of email from the parents."

The assistant principal described the challenges that Turner Middle School faces. "If you are in certain parts of the inner city, in the poorer sections, you know that you're going to have certain issues. This is a minority of parents but if you have parents that are on drugs, or that have to work two jobs, some kids don't see their parents. Sometimes the parents work nights." The school used to have a Saturday program, but lost the funding for it. "What was good about the Saturday program what that it was for the community. They had banking and computer classes. They had things to serve the entire community." However, the school still has after school and other programs for the students. "We work with a few community organizations. We have a couple of pals from the Boys and Girls Club. We have Meyers Recreational Center. They have an after school program called the Peaceful Posse to work with young men for conflict resolution. We work with Cop's Creek Environmental Education Center. From three to six p.m. they service the kids with their homework and deal with environmental education. . . . We also connect with the high school and they have students who come and do workshops for the kids and the teachers to teach them technology using video-cameras and digital equipment."

Turner Middle School has about 100 computers, many of which were obtained by a grant. There are two computer labs with approximately 30 computers in them. One of the labs, called "the learning center," is student-run. Some of the classrooms have computers as well, and since last year all of the classroom have a T1 connection. In addition to these resources, the school also has a weather station that they received from another grant.

The assistant principal, working in conjunction with the PIN site, brought the JASON program to Turner Middle School. The assistant principal used to teach and used JASON in his classes. He is now trying to make Turner a JASON school, so that everyone would incorporate the curriculum. According to the assistant principal, however, "We didn't have enough resources for everybody." Currently twelve teachers in the school use JASON,

involving about 300 students. "The only learning community that doesn't have a JASON teacher right now is the Science and Technology community," said the assistant principal. "The majority are in the Community and Environmental Studies." The JASON teachers at Turner attend JASON training workshops in the city.

The teacher who participated in this study is part of a special program at Turner. "I teach eighth grade math and science to a group of at-risk students, students who have either failed in the past or have behavioral problems who are trying to get into the correct classes. They range from sixth to eighth grade, but they are people who should be in eighth grade or even ninth at this time. I am not a special ed. teacher. They don't have emotional or learning problems but other problems, maybe at home or they've failed in classes. . . . When our kids came in this year they were reading on a second grade level." The assistant principal noted "The program is new this year. [The at-risk students] were in regular classes before. Our principal last year just thought that we should be able to serve them better because if they failed two or three times then there is something that we're doing that is not working. So we tried putting together a program that will be better suited for them."

One way the program tried to meet the needs of these students is to put them in smaller classes. Though the school's average class size is 31, the program's average class size is 21. Another way the program is designed to support the students is by having two very experienced teachers in charge of the program. These two teachers team-teach. The study teacher, who has 27 years of teaching experience, provides instruction in math and science, and her partner teaches language arts and social studies. Rather than having the students for short periods of time, the two classes of students are with each teacher for half of the school day. Another way the school chose to support the students was by having them participate in JASON. "We knew we had to give certain students additional support. So we thought, what can we give them?" said the assistant principal. "When we look at our curriculum we naturally see JASON as something to infuse because we had experience with it. We know it does work with our students."

Both of the program teachers have experience with JASON. They use the JASON activities all year long, and take an interdisciplinary approach to the material, using it in all of the subjects. In the view of the teachers and the assistant principal, JASON is especially appropriate for these students because it allows them to be active and take field trips outside of the school, and it gives them the opportunity to do hands-on projects. "This group is more excited about doing the projects than the kids last year [who were in a regular class]," said the study teacher. "With this group that's really what they want to do. They're excited because they can accomplish things, because the reading and writing they can't do. With the activities they can learn more and contribute. It's surprising how much they do know. They can't read it and write it but they can tell you verbally."

Canyon Junior High

Canyon, Texas

Canyon Junior High is located in Canyon, Texas, a small town (population 12,965) about twenty miles south of Amarillo. Canyon is a university town, home to Western Texas A & M University. Canyon Junior High is part of the Canyon Independent School District, which covers all of Randall County, Texas. The Canyon ISD has a total of 7,411 students in thirteen schools, three of which are middle schools. Twenty percent of the district's students are identified as economically disadvantaged.

Canyon Junior High has 633 students in grades 6 through 8 The vast majority of students are white (88%). There are some Hispanic students (10%) and very few African-American and Asian students. Seventeen percent of Canyon's students receive free or reduced price lunches, and less than 1% of students are identified as limited English proficient.

A total of 43 full-time teachers work at Canyon Junior High. About 28 of these are classroom teachers, and the rest teach art, music, Spanish, health, physical education, or serve as resource teachers for students with special needs. The faculty is quite experienced: the average number of years taught is 17.4, and 46% have been teaching for over 20 years. The average class size at Canyon Junior High is 24 students, although electives and advanced placement classes can be smaller.

In 2000 Canyon earned an "exemplary" campus rating from the state of Texas based on its scores on the Texas Assessment of Academic Skills (TAAS), a set of standardized tests in reading, writing, and math. Ninety-six percent of their students passed the reading test, 98% passed the writing test, and 98% passed the math test. Because the TAAS is broken down by ethnicity and socioeconomic status, the results of the test also reveal that Canyon's minority and economically disadvantaged students are passing the standardized tests at a high rate. On the reading test, 91% of Hispanic students and 94% of economically disadvantaged students passed, while on the math test 100% of Hispanic students and 99% of economically disadvantaged students passed. These scores are consistent with the scores in the district in general.

According to the principal, because Canyon is a university town, the community has high expectations of the school, and there is a high level of parental involvement. "We had close to 1,500 volunteer hours from our parents in the school last year," she reported. "They tutored, put up bulletin boards, whatever we needed. . . . It's so easy for us to pick up a phone and call and say, 'Hey will you help us with this?'" Canyon Junior High has been in its present location since 1974. "We have teachers here who went to this school and some who have taught here for almost thirty years," said the principal. Although the school has been a consistent part of the community for years, over the past decade the demographics of the community have changed as the town has grown. The student population has become more ethnically diverse, and though the town remains mainly middle-class, more and more of the students coming to Canyon Junior High are economically disadvantaged. The

transformation of the community "is going to continue," the principal predicted. "People are moving to our district because the reputation of our school. . . . We have been a recognized district for a long time."

Not only does the school's proximity to the university create high expectations for student achievement, it has also enabled Canyon to form a partnership with the university's education department. "We started two years ago participating as a professional development school," said the principal. "It was a new program the university started for education majors. . . . We've had really strong students who spent a few weeks with us and we have hired a lot of them." With a teaching shortage all over the state of Texas, forming a relationship with a pre-service education program has given Canyon a significant advantage in terms of teacher recruitment.

Three years ago the school received a grant that allowed them to connect every classroom in the school to the Internet and purchase 30 computers. At the same time, the Canyon Independent School District invested in technology as well, providing its schools with servers, printers, and wiring services. The school now has a total of 96 computers, with one in every classroom, in the library, and two computer labs (one has 30 computers and one has 15). The district's technology department provides technical support for the school. In addition, when the school received its technology grant, it sent seven teachers to training workshops so they would be able to help provide technical support within the school.

The state of Texas has established a set of curricular standards in all the major subject areas called Texas Essential Knowledge and Skills (TEKS). Teachers across the state must align their curricula to the state standards. Students in each middle school grade are tested yearly on the TEKS, and the state analyzes these standardized test scores at state, regional, district, school, and even classroom levels.

The JASON Project was introduced to the school three years ago by the regional PIN site coordinator, who is a professor at Western Texas A & M. The sixth-grade science teachers decided to use the curriculum that first year, and their enthusiasm inspired the eighth-grade teachers to take part in the JASON Project the following year. Although the district pays for the JASON workshops, the teachers have received varying levels of support for their participation in the training. "The first year the workshop was on a school day," said the sixth-grade science teacher who participated in our study, "but our districts wouldn't pay for substitutes, so we had to take a personal day." The second year the workshop was on a Saturday, and the teachers received a stipend for attending. This past year the workshop was again on a Saturday, but no stipend was offered. Because of this, only the science teachers went to the workshop. Teachers from the other disciplines did not bother to attend. "It's hard for teachers to get excited about spending a whole Saturday morning in a workshop," the science teacher explained.

Depending on how many teachers from disciplines other than science choose to make use of the materials, from six to ten sixth and eighth grade teachers at Canyon Junior High are

involved with the JASON Project each year, reaching about 400 students. All students who attend Canyon are exposed to JASON at some point. The JASON teacher we worked with has been teaching science for 22 years. She teaches sixth grade and thus has been involved with JASON since it was first brought to the school three years ago. This teacher picks and chooses the JASON labs and activities that can fit into the curriculum she has developed to meet the state and district standards. In her view one of the most engaging elements of JASON is the fact that it introduces students to real-world scientists. "It helps students to know that scientists are working on these projects. I can bring that into our discussions and activities and labs. It makes the science more relevant, especially when we get to go to the Tele-presence. They are always excited because they already know a lot of the scientists."

Slinger Middle School

Slinger, Wisconsin

Slinger is a small town, about 30 miles northwest of Milwaukee, with a population of approximately 2,300. Although it is becoming a bedroom community for commuters, the town maintains a rural appearance, with farms surrounding it. Slinger Middle School is part of the Slinger School District, which serves seven different municipalities around the town of Slinger. The district comprises two elementary schools, one middle school, and one high school, and serves 2,700 students. District-wide, 4.5% of students receive free or reduced-price lunch.

The beautifully designed Slinger Middle School is situated on a quiet street in a new housing development. At the end of the entrance hall huge are multistory windows looking out onto playing fields. The main section of the school is three stories high, and each floor is given over to a single grade's academic classrooms. Each floor also has a computer lab and a large, central, teacher planning room equipped with a large table where all of the grade-level teachers can sit together.

Slinger Middle School has 676 students in grades 6 through 8. Only about 1.5% of the students at Slinger are non-white. Most students are middle-class, though the socioeconomic make up of the community is somewhat heterogeneous (with a mean income level of $12,000 and a median income level of $30,000). Eleven percent of the students are identified as having physical or learning disabilities.

Thirty-nine teachers work at Slinger Middle School, making the student-teacher ratio

Observation in November, Slinger Middle School, Slinger, Wisconsin

Our observation is conducted on a day in which the entire morning, from 7:45 to 12:00, is blocked out for JASON. Normally the morning is segmented into 50-minute classes, but the school is organized so that teachers can sometimes schedule large blocks of time for certain activities. This is the second time in the year that a large chunk of the day is dedicated to a JASON activity. All of the teachers in the seventh grade are doing the same project in their classrooms. The activity is one that the teachers are reusing from JASON X. It involves designing and constructing a bird. The two science teachers decided to reuse this activity because there is no design activity in JASON this year, and they felt that a design activity is a good way to start off the JASON Project and get the kids excited. However, they adapt the older lesson to this year's JASON Project by telling the students that the birds they are making are to be indigenous to Hawaii, such as Honeycreepers.

This observation takes place in the two

17.5:1. The average class size is 26. The seventh- and eighth-grade teachers instruct in specific subject areas, such as science, math, language arts, and social studies, though a few teachers teach more than one subject area. Along with their academic subjects, Slinger students take art, music, shop, and physical education. Slinger teachers average fifteen years of teaching.

On the 2000–2001 academic year, the Wisconsin School Assessment System (WSAS) standardized test, given to all fourth, eighth and twelfth graders in Wisconsin, 89% of Slinger's eighth grade students scored in the proficient or advanced categories, levels significantly higher than the state average (73%). For this reason Slinger ranks in the 81 percentile on this test. Interestingly, of the female students at Slinger who took the test, 38% scored in the proficient category and 54% scored in the advanced category. With the boys taking the test, it was almost exactly the reverse—52% had proficient scores and 36% received advanced scores.

The principal of Slinger described the community as a mixture of "blue-collar hard-working farmers and, because of our proximity to Milwaukee, the more upwardly mobile, affluent type people who started building their $500,000 homes out here. We also have our trailer parks and low income housing." Despite this socio-economic diversity, he observed, "The one thing they have in common is they support the schools." This support is what enabled Slinger to build their new middle school. "The referendums [for education funding] that have passed have always passed with something like a 60-40 type of majority. When we have a band concert, my biggest problem is enough room. We have a gym and a half here and it's packed. The support is just amazing."

science rooms, which are fairly large rooms with a small storage room in between that the two teachers share. The activity calls for students, working in pairs, to design and build birds from oak tag paper and Styrofoam. The kids glue pieces of drinking straws and dowels to the oak tag wings to make them aerodynamic. Later in the week the students will "fly" their birds by sliding them down a wire. There is a contest in the bird design project. Birds will be judged in four categories: most colorful, fanciest, most life-like, and fastest.

The students are sitting at tables covered with construction materials—tissue paper, pipe cleaner, magic markers, scissors, etc. Students walk around the room, work on the Styrofoam bodies that were drying on the counter, talk to the teacher and to each other. For two hours of our observation there is no direct instruction. The students work on their own and seek assistance when they have questions. In each room three parent volunteers with the students. Both of the teachers and most of the parent volunteers are wearing JASON T-shirts and sweatshirts.

As two girls work on their bird, they talk about the JASON Project. One girl says she likes JASON because they get to do

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As mentioned above, the Slinger Middle School has three computer labs, one on each of the grade-level floors, as well as a writing lab where the school puts its older computers. All of the labs are connected to the Internet. All of the teachers have a networked computer in their classrooms, though the principal observed that those were used more for managerial purposes than for student work. Overall, there are 900 computers in the school, including administrative computers. "We are very lucky to have a superintendent who really believes in technology," said the principal. "He thinks it's a more efficient way of getting things done. He's been very good with providing funds for that." Most of the funding for the school's technology infrastructure comes from the district.

The state of Wisconsin evaluates the school in two ways. One is a voluntary approach, in which the school, working in a consortium of other schools, reviews its own curriculum and generates a report. The school is then audited every five years by outside evaluators from a university in the state of Wisconsin. The school is also evaluated through test scores, which are published in the newspapers every spring. The principal noted that this emphasis on testing is fairly new. Although they have always tested the students before, the stakes are getting higher for the tests. The state is planning to tie grade promotion and graduation to the test scores. District curriculum committees for each subject meet every seven years to review the curriculum to make sure it is aligned to the state standards.

Nine years ago the JASON Project was introduced to the school by one of Slinger's two seventh-grade science teachers, and they have done the program every year since. "When we got involved with JASON we liked it so much that I presented it to the district curriculum committee," said the teacher who brought JASON to the school. "They thought it was

activities. "Would you rather sit quietly and write out vocabulary words?" she asks. Her partner says, "Yes." JASON requires too much work, she complains. She points to the blackboard, which lists all of the assignments that will be due over the year as evidence for all the work involved with JASON. A boy agrees that science is much harder this year because of JASON, but it is also much more fun.

All of the students in the seventh grade create special JASON folders that they decorate themselves, some quite elaborately. These are three-ring binders, which serve as a kind of portfolio. The binders have eight sections and contain all the work students do for JASON throughout the year, all the assignments, the research articles, their paper journals, and other JASON material. The students record their reflections about each project in journals in their JASON notebooks. They summarize these daily reflections each Friday and post their summaries and questions on the Team JASON Online site.

Part of the bird design activity has the kids use a graph to calculate the area of the bird wing, both with feathers and without. They put their completed graphs in their binders. The students cut out the

valuable enough to be a part of the overall curriculum and decided that all seventh graders (about 225 students this year) in Slinger Middle School would be exposed to the JASON Project." The two science teachers attend the JASON teacher training in the fall. Once they receive the curriculum materials, "our principal is kind," said the other science teacher, "and gives us a whole day of release time and we sit the whole day and lay out the curriculum and do our ordering [of materials]. " One of the seventh-grade science teachers was also a JASON teacher Argonaut a few years ago.

All of the subject teachers in the seventh grade (a total of nine) are involved with the JASON Project to some degree, although the science teachers are the most actively involved. In the fall the teachers set aside a full day to do "sectionals," in which each seventh grade teacher introduces a class of students to one aspect of the JASON Project they will be exposed to over the year, and the students rotate through all of the different classrooms. Two more days each year are set aside for JASON activities, including the field trip to the Tele-presence in Milwaukee. In the spring the science and English teachers collaborate on a JASON activity in which the students write their final research paper for English on a JASON topic, and then turn that paper into a poster for their final science project.

According to both the science teachers and the principal the JASON Project is strongly supported by parents as well as the school and district administration. "When we have our orientation for JASON [in the fall] for the parents," claimed one of the science teachers, "we have an incredible turn-out. About 90–95% come." The other science teacher added, "The entire cafeteria is full, and they're standing in the hallways. . . . We print out a brochure that we give to all the families with the timelines for when assignments are due,

form of the wing from a handout, so all the wing shapes are the same but the students all color the wings differently. They follow directions on a handout that tells them how to attach the straws and dowels to the bottom of the wing, but some students need to add extra cardboard to the underside of the wing to balance it. They also put their graphs, on which they figure the cubic area, in their binders.

The Styrofoam bodies, which were covered in all different colors of wet tissue paper, are drying under heat lamps on the counters around the classroom. Some students are standing at the counter, using a glue gun to attach pipe cleaner feet to the Styrofoam body of their bird. The kids have to design the birds and map out the colors before they actually begin their construction. They keep these designs in their binders.

Some of the kids have trouble with different aspects of the construction, such as attaching the wings to the bodies, but the birds they make are very pretty. They pay a lot of attention to detail. It seems as though most are competing for the "Most Colorful" prize.

The two science teachers say they are think-

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when the Tele-presence is so the parents know what's involved. Then we get our parent volunteers to sign up. We just found it was a good way to get the parents involved right from the start." The principal mentioned that the parents also support the project financially. "My budget really can't support transportation and it costs $1000 to take the class to Milwaukee [for the Tele-presence] for a day. We have to have a fundraiser to help offset some of the cost and we have no problem with that," he said. "Parents see how excited their kids are about JASON. . . . So when you're a parent and your kid comes home all bubbling over about what they did in science, that's something."

ing that next year they might not give the students directions about how to design and construct the bird, but rather they may just give the students the materials and tell them, "Design a bird." Throughout the morning other seventh grade teachers come into the room to ask these teachers for advice or supplies. The teachers, were are observing, are clearly the JASON leaders in the school. When the students are done with their birds the teachers hang them from the ceiling of the classroom and in the hallway.

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